1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^3 - 41x^2 + 27x + 18$$

   A. $z_1 \in [-3.1, -2.9]$, $z_2 \in [-1.7, -0.7]$, and $z_3 \in [0.23, 0.73]$

   B. $z_1 \in [-2.9, -1.5]$, $z_2 \in [0.2, 0.8]$, and $z_3 \in [2.77, 3.08]$

   C. $z_1 \in [-3.1, -2.9]$, $z_2 \in [-1.1, 0]$, and $z_3 \in [2.35, 2.69]$

   D. $z_1 \in [-3.1, -2.9]$, $z_2 \in [-3.2, -2.7]$, and $z_3 \in [0, 0.29]$

   E. $z_1 \in [-1.9, 0]$, $z_2 \in [0.8, 2]$, and $z_3 \in [2.77, 3.08]$

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 + 11x^2 - 106x + 44}{x + 4}$$

   A. $a \in [9, 11]$, $b \in [-46, -31]$, $c \in [84, 95]$, and $r \in [-401, -396]$.

   B. $a \in [-44, -39]$, $b \in [-152, -148]$, $c \in [-703, -700]$, and $r \in [-2765, -2760]$.

   C. $a \in [9, 11]$, $b \in [46, 56]$, $c \in [98, 100]$, and $r \in [425, 441]$.

   D. $a \in [-44, -39]$, $b \in [168, 175]$, $c \in [-796, -787]$, and $r \in [3196, 3209]$.

   E. $a \in [9, 11]$, $b \in [-29, -25]$, $c \in [8, 15]$, and $r \in [3, 7]$.

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3. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{9x^3 - 28x - 19}{x - 2}$$

   A. $a \in [14, 26], b \in [-36, -34], c \in [40, 45]$, and $r \in [-108, -105]$.

   B. $a \in [6, 12], b \in [-22, -17], c \in [0, 12]$, and $r \in [-35, -34]$.

C. $a \in [6, 12], b \in [6, 15], c \in [-23, -18],$ and $r \in [-42, -37]$.

D. $a \in [14, 26], b \in [36, 38], c \in [40, 45],$ and $r \in [65, 74]$.

E. $a \in [6, 12], b \in [16, 20], c \in [0, 12],$ and $r \in [-8, 1]$.

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4. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^3 + 35x^2 - 9x - 18$$

A. $z_1 \in [-1.5, -1.26],\ z_2 \in [0.92, 1.85],$ and $z_3 \in [2.5, 3.1]$

B. $z_1 \in [-0.8, -0.64],\ z_2 \in [0.48, 0.77],$ and $z_3 \in [2.5, 3.1]$

C. $z_1 \in [-3.17, -2.34],\ z_2 \in [-1.51, -1.46],$ and $z_3 \in [1.1, 2.4]$

D. $z_1 \in [-3.17, -2.34],\ z_2 \in [-0.74, -0.58],$ and $z_3 \in [0, 1.1]$

E. $z_1 \in [-0.34, -0.12],\ z_2 \in [1.58, 2.09],$ and $z_3 \in [2.5, 3.1]$

---

5. Factor the polynomial below completely, knowing that $x - 4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^4 - 14x^3 - 248x^2 + 224x + 128$$

A. $z_1 \in [-5, -2],\ z_2 \in [-4.5, -3.89], z_3 \in [-0.08, 0.26],$ and $z_4 \in [2, 8]$

B. $z_1 \in [-5, -2],\ z_2 \in [-3.04, -2.45], z_3 \in [0.73, 0.85],$ and $z_4 \in [2, 8]$

C. $z_1 \in [-5, -2],\ z_2 \in [-0.52, -0.21], z_3 \in [1.24, 1.46],$ and $z_4 \in [2, 8]$

D. $z_1 \in [-5, -2],\ z_2 \in [-1.72, -1.22], z_3 \in [0.18, 0.71],$ and $z_4 \in [2, 8]$

E. $z_1 \in [-5, -2],\ z_2 \in [-0.94, -0.69], z_3 \in [2.44, 2.56],$ and $z_4 \in [2, 8]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{9x^3 + 27x^2 - 25x - 77}{x + 3}$$

A. $a \in [9, 10],\ b \in [-2, 2],\ c \in [-27, -24],$ and $r \in [-9, 0]$.

B. $a \in [-32, -24],\ b \in [107, 111],\ c \in [-350, -348],$ and $r \in [968, 976]$.

C. $a \in [9, 10],\ b \in [53, 60],\ c \in [133, 143],$ and $r \in [334, 340]$.

D. $a \in [9, 10],\ b \in [-10, -7],\ c \in [11, 16],$ and $r \in [-121, -118]$.

E. $a \in [-32, -24],\ b \in [-55, -51],\ c \in [-188, -186],$ and $r \in [-642, -633]$.

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7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 + 30x^2 - 44}{x + 2}$$

A. $a \in [-21, -16], b \in [69, 73], c \in [-140, -137],$ and $r \in [232, 243]$.

B. $a \in [-21, -16], b \in [-12, -7], c \in [-21, -15],$ and $r \in [-88, -81]$.

C. $a \in [6, 11], b \in [46, 51], c \in [97, 101],$ and $r \in [153, 159]$.

D. $a \in [6, 11], b \in [9, 17], c \in [-21, -15],$ and $r \in [-4, -3]$.

E. $a \in [6, 11], b \in [-5, 6], c \in [-2, 3],$ and $r \in [-50, -42]$.

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8. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 3x^3 + 2x^2 + 4x + 7$$

A. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 7}$

B. $\pm 1, \pm 3$

C. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 3}$

D. $\pm 1, \pm 7$

E. There is no formula or theorem that tells us all possible Rational roots.

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9. Factor the polynomial below completely, knowing that $x+3$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^4 + 51x^3 - 28x^2 - 333x - 180$$

A. $z_1 \in [-0.74, -0.5], \ z_2 \in [2.94, 3.06], z_3 \in [1.8, 3.3]$, and $z_4 \in [4, 5]$

B. $z_1 \in [-4.18, -3.74], \ z_2 \in [-3.13, -2.89], z_3 \in [-0.8, -0.4]$, and $z_4 \in [2.5, 3.5]$

C. $z_1 \in [-0.47, -0.25], \ z_2 \in [1.43, 2.14], z_3 \in [1.8, 3.3]$, and $z_4 \in [4, 5]$

D. $z_1 \in [-2.55, -2.47], \ z_2 \in [-0.59, 1.11], z_3 \in [1.8, 3.3]$, and $z_4 \in [4, 5]$

E. $z_1 \in [-4.18, -3.74], \ z_2 \in [-3.13, -2.89], z_3 \in [-2.8, -1.2]$, and $z_4 \in [0.4, 1.4]$

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10. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 4x^3 + 4x^2 + 6x + 6$$

A. $\pm 1, \pm 2, \pm 3, \pm 6$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 2, \pm 3, \pm 6}$

C. $\pm 1, \pm 2, \pm 4$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 2, \pm 4}$

E. There is no formula or theorem that tells us all possible Rational roots.
